REMARKS ON THE PEGASUS CLUSTER OF NEBULAE

BY J. B. EDSON AND F. ZWICKY

CALIFORNIA INSTITUTE OF TECHNOLOGY, PASADENA

Communicated July 7, 1941

In continuation of some researches previously reported on the structure of clusters of nebulae we here discuss some of the data obtained with the 18-inch Schmidt telescope on Palomar Mountain concerning the Pegasus

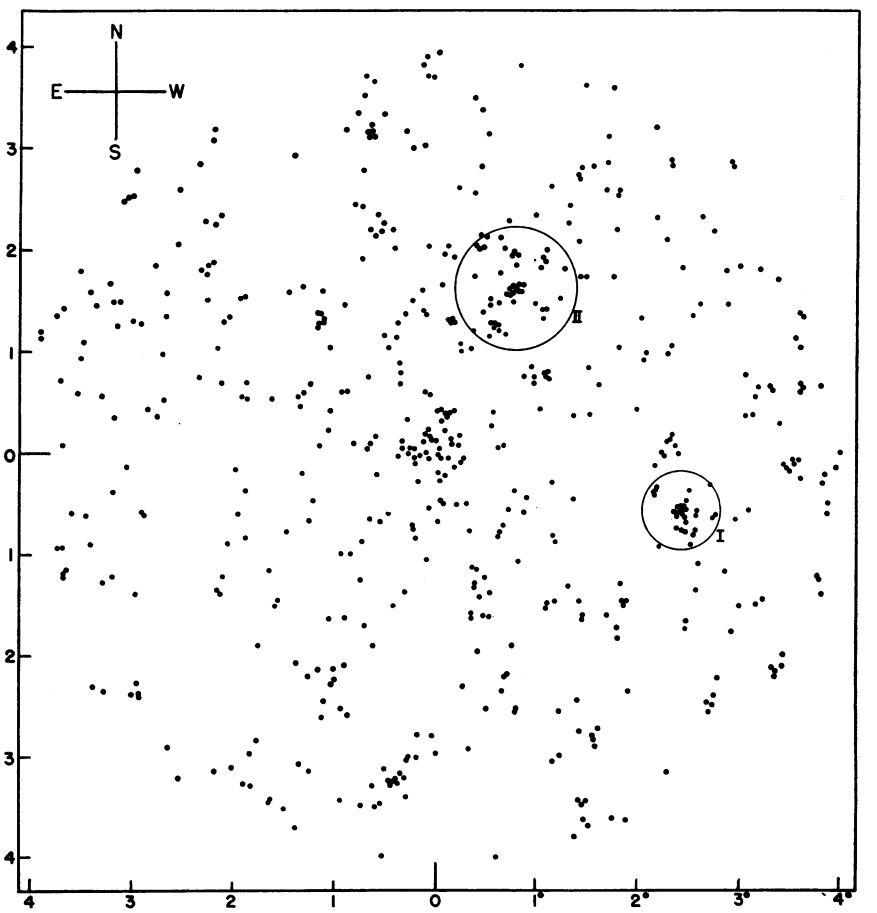

FIGURE 1

Distribution of nebulae around the Pegasus Cluster.

cluster of nebulae (R.A. $23^h\ 17^m$; Decl. $+ 7° 50'$, 1930; gal. long. 55°, lat. $-49°$). According to Hubble and Humason[1] this cluster consists of about 100 nebulae scattered over an area roughly 1° in diameter. The Pegasus

cluster lies at a distance of about 7.25 million parsecs and is centered around the two brightest objects NGC 7619 and 7626 which are slightly fainter than the photographic apparent magnitude 13. The most frequent apparent magnitude in the cluster is about 15.5.

The distribution of the nebulae brighter than about $m = 16.6$ in the cluster and in its immediate neighborhood is shown in figure 1 in which 556 nebulae are plotted. It is at once apparent that the field shown around the Pegasus cluster proper, which is located in the center, contains at least

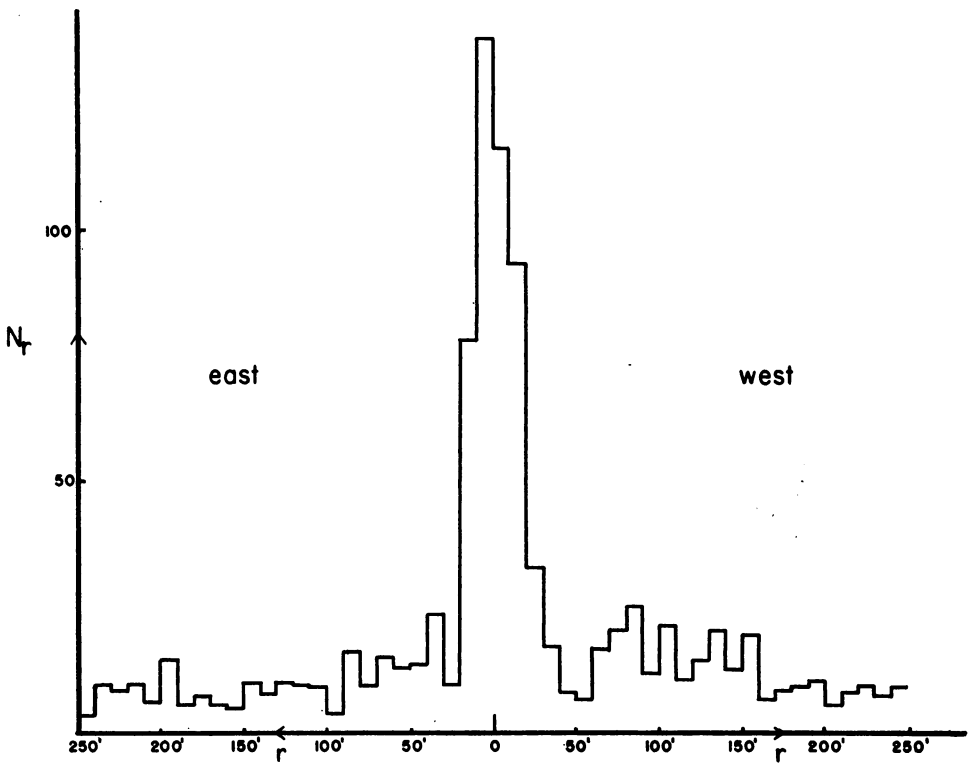

FIGURE 2
Radial distribution of nebulae in the Pegasus Cluster.

two other large groups marked by the two circles. The cluster enclosed by the circle I which is located in the constellation of Pisces was previously discovered by Zwicky. A plate taken with the 100-inch telescope and kindly put at our disposal by Dr. Baade shows this cluster to be of a compact type which contains at least 200 nebulae. Some of the structural characteristics of this interesting cluster will be discussed in another paper.

The field shown in figure 1 seems to form the southwestern end of the enormous cloud of nebulae extending from the constellation of Andromeda through Pisces to the large cluster of nebulae in Perseus. This cloud exhibits a characteristic mottled appearance which is due to the existence of

many relatively compact subgroups. Some of these subgroups in Pisces were previously discussed.[2]

Adopting as the center of the Pegasus cluster the point halfway between its two brightest objects the field was subdivided into rings with successive outer radii $r_n = n \times 10'$ arc. The number of nebulae in each ring was counted in the quadrants defined by the north south and east west directions, respectively. The results obtained are tabulated in table 1 and illustrated in figure 2.

TABLE 1

COUNTS OF NEBULAE IN RINGS WHOSE WIDTH IS 10 MINUTES OF ARC

RING	QUADRANTS SW	SE	NE	NW	n_r	N_r/SQ. DEGREE
1	3	3	3	2	11	127.6
2	6	4	6	6	22	85.0
3	1	1	1	6	9	20.9
4	3	2	5	2	12	19.9
5	1	3	2	2	8	10.3
6	3	3	3	0	9	9.5
7	5	2	6	4	17	15.1
8	3	3	3	10	19	14.7
9	6	3	8	12	29	19.8
10	4	1	2	5	12	7.3
11	3	0	8	16	27	14.9
12	4	5	4	6	19	9.6
13	3	5	5	12	25	11.6
14	13	3	6	10	32	13.7
15	8	5	7	7	27	10.8
16	18	5	2	7	32	11.9
17	8	5	3	1	17	6.0
18	8	3	8	4	23	7.6
19	6	4	5	8	23	7.2
20	6	10	14	10	40	11.9
21	3	6	5	6	20	5.7
22	9	10	8	5	32	8.6
23	8	8	8	9	33	8.5
24	6	10	9	8	33	8.1
25	15	4	3	3	25	5.9
Total	153	108	134	161	556	

The number of nebulae in the ring of outer radius r is n_r while the average number of nebulae per square degree in each ring is N_r.

The average number of nebulae per square degree as plotted in figure 2 was calculated separately for the half spaces east and west of the center of the Pegasus cluster. This brings into evidence the fact that the values of N_r in the western half space are relatively large for those rings which cover the two additional clusters.

It follows from figure 2 that the Pegasus Cluster is considerably smaller than the Hydra cluster[3] which lies at about the same distance. As stated by Hubble and Humason[1] the apparent diameter of the Pegasus Cluster is of the order of about 1°. Its intrinsic characteristics are probably very similar to some of the less populated more nearby groups of nebulae such as the group in Fornax (R.A. $3^h\ 30^m$; Decl. $-36°$) which we shall discuss in another place.

The general background of the field shown contains on the average about 8.5 nebulae per square degree. Of the 556 nebulae shown about 462 constitute the general background of the circular field of 250′ arc radius. The remaining 94 nebulae belong to the Pegasus Cluster (about 30) and to the two other clusters.

Our counts cover all nebulae which on the average are brighter than the apparent magnitude $m = 16.6$. According to Hubble[4] the number N_m of nebulae per square degree which are brighter than the apparent magnitude m is given by

$$\log_{10} N_m = 0.6m - 9.1 + 0.15(1 - \operatorname{cosec} \beta)$$

where the last term is the correction for average local obscuration at the galactic latitude β. For $m = 16.6$ and $\beta = -49°$ we therefore have $N_m = 6.5$ nebulae per square degree. This number is somewhat smaller than the average of 8.5 nebulae found in the background of our field, a result which is probably due to the fact that some nebulae of this background belong to the very extended cloud of nebulae mentioned previously.

On our films there is a marked scarcity in the number of nebulae as well as that of stars in a ring about 40′ from the center of the Pegasus Cluster. Whether this scarcity is accidental or whether it is due to some interstellar obscuration cannot here be decided, although it seems unlikely that at the galactic latitude of $-50°$ much obscuring material should be expected.

[1] E. Hubble and M. L. Humason, *Astrophys. Jour.*, **74**, 131 (1931).
[2] F. Zwicky, these PROCEEDINGS, **23**, 251 (1937).
[3] F. Zwicky, *Ibid.*, **27**, 264 (1941).
[4] E. Hubble, *The Realm of Nebulae* (Yale University Press, 1936, p. 179).